

WHAT IS CLAIMED IS:

1. A particle dispersion comprising a liquid and a collection of particles at a concentration of less than about 50 weight percent in the dispersion, the collection of particles having an average primary particle diameter less than about 100 nm and effectively no particles having a primary particle diameter greater than about three times the average primary particle diameter.

2. The particle dispersion of claim 1 having an average secondary particle size less than about 1000 nm.

3. The particle dispersion of claim 1 wherein the particles comprise a compound selected from the group consisting of silicon nitride, silicon carbide, Al_2O_3 , CeO_2 , TiO_2 , MnO , ZnO , $MnCO_2$, Mn_2O_3 , Mn_3O_4 , SnO_2 , Fe_2O_3 , ZrO_2 , SiO_2 , alumina silicate, alumina titanate, carbon, and mixtures thereof.

4. The particle dispersion of claim 1 wherein the particles comprises a metal oxide.

5. The particle dispersion of claim 1 wherein the solvent has a pH less than about 4 pH units.

6. The particle dispersion of claim 1 wherein the solvent has a pH less than about 3 pH units.

7. The particle dispersion of claim 1 wherein the solvent has a pH greater than about 9 pH units.

8. The particle dispersion of claim 1 wherein the solvent has a pH from about 9 pH units to about 11 pH units.

9. The particle dispersion of claim 1 wherein the solvent has a pH from about 6 pH units to about 8 pH units.

10. The particle dispersion of claim 1 further comprising a surfactant.

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11. The particle dispersion of claim 10 wherein the surfactant is selected from the group consisting of octoxynol, nonxynol, and dodecyl trimethyl ammonium bromide.

12. The particle dispersion of claim 1 further comprising an oxidizing agent.

13. The particle dispersion of claim 12 wherein the oxidizing agent is selected from the group consisting of potassium ferricyanide, potassium iodate hydrogen peroxide, and ferric nitrate.

14. The particle dispersion of claim 1 wherein the liquid comprises water.

15. The particle dispersion of claim 1 wherein the liquid comprises an organic liquid.

16. The particle dispersion of claim 15 wherein the organic liquid is selected from the group consisting of alcohols, acetone, carboxylic acids.

17. The particle dispersion of claim 1 wherein the liquid comprises a solution of water and an organic solvent.

18. The particle dispersion of claim 1 wherein the average primary particle diameter is from about 5 nm to about 50 nm.

19. The particle dispersion of claim 1 wherein the concentration of the collection of particles is less than about 30 weight percent.

20. The particle dispersion of claim 1 wherein the concentration of the collection of particles is less than about 20 weight percent.

21. The particle dispersion of claim 1 wherein the concentration of the collection of particles is less than about 10 weight percent.

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22. The particle dispersion of claim 1 wherein the concentration of the collection of particles is less than about 5 weight percent.

23. The particle dispersion of claim 1 wherein the collection of particles effectively having no particles with a primary particle diameter greater than about two times the average primary particle diameter.

24. The particle dispersion of claim 1 wherein the collection of particles have a distribution of diameters of the primary particles such that at least about 95 percent of the primary particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the average diameter.

25. The particle dispersion of claim 1 wherein the particles are produced by laser pyrolysis.

26. A method of polishing a surface comprising abrading the surface with a dispersion of claim 1.

27. The method of claim 26 wherein the surface comprises a plurality of compositions and wherein the dispersion has a selective removal with the removal rate of one surface composition being at least about 5 times greater than the removal rate of another surface composition.

28. A method for forming a particle dispersion, the method comprising mixing a collection of particles with a liquid, the collection of particles having an average primary particle diameter from about 5 nm to about 50 nm and effectively no particles having a primary particle diameter greater than about three times the average primary particle diameter.

29. A method for polishing a surface comprising a metal or metal compound, the method comprising abrading the surface with a particle dispersion having a concentration of particles less than about 5 weight

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percent and the particle dispersion comprising a collection of particles having an average primary particle diameter less than about 100 nm.

30. The method of claim 29 wherein the particle dispersion has a concentration of particles less than about 3 weight percent.

31. A method for polishing a surface comprising metal or a metal compound, the method comprising abrading the surface with a particle dispersion, the particle dispersion comprising a collection of particles having an average primary particle diameter less than about 100 nm, the abrasion removing greater than about a factor of two more material from the surface per unit time than corresponding polishing with an equivalent concentration of particles having an equivalent composition and an average particle diameter of greater than about 1 micron.

32. A method for polishing a surface comprising a metal or a metal compound, the method comprising abrading the surface with a particle dispersion to produce a surface with a root mean square roughness of less than about 0.75 nm.

33. A device having a surface with a coating comprising a collection of particles having an average primary particle diameter less than about 100 nm and effectively no particles having a primary particle diameter greater than about three times the average primary particle diameter.

34. The device of claim 33 wherein the collection of particles have a distribution of sizes such that at least about 95 percent of the primary particles have a diameter greater than about 40 percent of the average diameter and less than about 160 percent of the average diameter.

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35. The device of claim 34 wherein the device comprises a field emission device and the collection of particle comprise phosphor particles.

36. The device of claim 34 wherein the device comprises a microelectronic integrated circuit and the collection of particles form a barrier layer, electrical interconnect, or insulating layer within the integrated circuit.

37. The device of claim 34 wherein the device comprises an imaging device and the collection of particles comprise photocatalytic particles.

38. The device of claim 34 wherein the device comprises a machine tool with a hard surface coating comprising the collection of particles.

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